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Nr. 3. Johs. Schmidt: ON PELAGIC POST-LARVAL HALIBUT (*HIPPOGLOSSUS VULGARIS* FLEM. AND *H. HIPPOGLOSSOÏDES* [WALB.]). (WITH 1 PLATE)

KØBENHAVN
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ON PELAGIC POST-LARVAL HALIBUT

(*HIPPOGLOSSUS VULGARIS* FLEM. AND *H. HIPPOGLOSSOÏDES* [WALB.])

BY

JOHS. SCHMIDT

(WITH 1 PLATE)

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Though early pelagic stages of the ordinary halibut (*Hippoglossus vulgaris*) have been mentioned in literature more than once, they have hitherto been unknown. I shall begin by recording the reports in the literature dealing with this matter. In the "Report of the Danish Biol. Station, IV, 1893, Pl. I, Fig. 20" C. G. Joh. Petersen figures a pelagic post-larval flat-fish from Norway as *Hippoglossus vulgaris*. Early post-larval stages of a pleuronectid have later on been described and figured by H. M. Kyle (M. B. A., Journal VI, p. 618, 1903) as belonging to the halibut or *Pleuronectes cynoglossus*; the correctness of these statements has however been disputed by Holt and Byrne (Dep. of Agriculture for Ireland, Report on Fisheries for 1901, p. 67, 1903), who give their reasons for regarding the specimens described by Petersen and by Kyle as early stages of the witch or pole dab (*Pleuronectes cynoglossus*), an opinion which has been confirmed by the later authors dealing with this question (see Petersen, 1904, and Williamson, 1904).

Pelagic fry of the Greenland halibut (*Hippoglossus hippoglossoïdes*)[1]) has only been mentioned once, namely by Petersen in the above recorded work (Rep. Danish Biol. Station, IV, 1893), where a specimen of a length of 51^{mm} from Greenland is represented on Pl. I. Fig. 21.

In a later treatise (Meddel. fra Komm. for Havundersøgelser, Serie Fiskeri, Bind I, No. 1 1904, p. 3), containing a description of the development of *Drepanopsetta*, *Pleuronectes microcephalus* and *cynoglossus*, Petersen again briefly dwells on the question and settles, that the post-larval flat-fish formerly figured and mentioned by him as a „*Hippoglossus vulgaris*" is a *Pl. cynoglossus* of which we at present know the whole series of different stages exceedingly well[2]). The present view of the question is characterized by Petersen in the following words: "The larval halibut is still unknown, unless the second young one represented by me in „Beretning IV" as a *Hippoglossus hippoglossoïdes* from Greenland (Fig. 21), and which evidently is pelagic in spite of its 51^{mm} length should be a larva of the ordinary halibut. Its bad preservation makes it impossible to count the dorsal fin-rays with any accuracy, and in the anal-fin it is only possible to count 70 rays, so it may just as well be ascribed to *H. vulgaris* as to *H. hippoglossoïdes* (see p. 5). Consequently this case will for the present have to be left unsettled".

This was till quite recently the state of the question. Only one of the young flat-fishes described as halibut can be accepted as a young halibut, namely, that figured by Petersen in the first mentioned treatise Pl. I. Fig. 21. Whether it belongs to the one or other of the two species of *Hippoglossus* could not be ascertained however, as the number of fin-rays is overlapping in the two species, and the number of vertebrae not sufficiently known.

[1]) This fish is in Danish Greenland called "Hellefisk", in Norway "Svartkveite" and "Blue halibut" by the British fishermen, who occasionally catch it at Iceland.

[2]) A complete series of post-larval and young witches are figured in this last work by Petersen, on Pl. II, and in a later published paper by Williamson (F. B. Scotland, 22th Annual Report, Part III, 1904, p. 270, Plate XVI), so that a future confounding of the fry of *Pl. cynoglossus* with that of any other species is quite out of the question.

I shall now proceed to mention what I have to communicate with regard to this matter[1]). During the "Thor"s second cruise to Iceland and the Færoe Isles in 1904 I had the opportunity to examine a considerable number of full-grown halibut, belonging both to *Hippoglossus vulgaris* and to *H. hippoglossoïdes*. In some specimens the rays of the dorsal- and anal-fin as well as the vertebrae were counted. The result was as follows:

Ordinary halibut *(H. vulgaris)*
54 specimens caught round Iceland and the Færoe Isles

Vertebrae without and with lower arches	Number of specimens investigated
16 + 33	9
16 + 34	**38**
16 + 35	5
17 + 32	1
17 + 33	1

Blue halibut *(H. hippoglossoïdes)*
20 specimens caught E. of Iceland

Vertebrae without and with lower arches	Number of specimens investigated
17 + 44	1
18 + 43	3
18 + 44	**11**
18 + 45	4
19 + 43	1

Number of rays in Dorsal	Number of specimens investigated	Number of rays in Anal	Number of specimens investigated	Number of rays in Dorsal	Number of specimens investigated	Number of rays in Anal	Number of specimens investigated
108	1	83	1	103	2	79	1
			1		2		
106	6	81	1	101	3	77	1
	3		6				
104	7	79	9	99	1	75	5
	7		10		4		3
102	3	77	8	97	1	73	1
	4		3		3		1
100	7	75	4	95	4	71	5
	4		6				1
98	5	73	3			69	1
	3		1				1
96	3	71				67	

The figures stated show, that while the number of fin-rays generally will not enable us to separate the two species of halibut[2]), we possess an excellent character in the number of vertebrae, *H. vulgaris* having usually 16 + 34, *H. hippoglossoïdes* on the contrary 18 + 44 vertebrae. Among the hauls, so exceedingly rich in pelagic young-fishes, which I made this year round Iceland and the Færoe Isles with PETERSEN's young-fish trawl, several contained dextral post-larval flat-fishes, different from those known before. I now clearly understood, that they belonged to the halibut. The high number of fin-rays pointed in this direction, and what was more important I could count with accuracy the vertebrae in several specimens, while these were still perfectly clear and transparent.

[1]) It must also be noted that HOLT and BYRNE (Ann. and Mag. of Nat. Hist. vol. 14, No. 79, July 1904, p. 40) quite recently mention a larval fish caught from the "Oceana" under the name *Hippoglossus vulgaris*? viz:

"a vitelligerous larva, with a total length of 10·5mm and a preanal l. of 4mm, appears to be a Pleuronectid, the body segments cannot be counted with great accuracy, but probably number about forty eight; the yolk-sac is still very large and the mouth not yet functional. The specimen is somewhat damaged and darkly stained by the preserving medium. The marginal larval fin — whether naturally or otherwise — appears to be much vacuolated, especially dorsally, while the only visible pigment consists of a few stellate chromatophores in the roof of the body cavity" (HOLT and BYRNE l. c.). As a no more detailed description, nor an illustration of the larva is offered, it is impossible to say, if the authors are right in saying: "If this larva is correctly identified as a Pleuronectid, it can only be attributed to the halibut, both on account of its size and by a process of elimination". Consequently it may far less be determined, if it eventually belongs to *H. vulgaris* or *H. hippoglossoïdes*.

[2]) In the last mentioned work by PETERSEN the following figures for the two species have been quoted from SMITT and COLLETT.

	Rays in Dorsal	Rays in Anal
Hippoglossus vulgaris	110—98	85—73
— *hippoglossoïdes*	102—92	76—71

In this way I obtained the figures 16 + 34 and was consequently able to identify them as belonging to *Hippoglossus vulgaris*. Later on I subjected some of the specimens preserved in 2 ‰ formaline to repeated countings and obtained the same result. No pelagic fry of *H. hippoglossoïdes* has been caught by the "Thor". A number of post-larval and young flat-fishes from Greenland however, is kept in the Zoological Museum of Copenhagen, partly originating from the Danish Ingolf-Expedition and partly from older collections, and these I have now been able with certainty to specify as belonging to *H. hippoglossoïdes* knowing the young one of the ordinary halibut from the "Thor"s investigations.

I shall now proceed to give a description of the pelagic stages of the two species, as far as these are known from the material now at hand, which partly consists of about 20 *Hippoglossus vulgaris*, caught by myself from the "Thor" off Iceland and the Færoe Isles, partly of about 10 Greenland specimens of *H. hippoglossoïdes*, which I have received from the Zoological Museum of Copenhagen.

I. *Hippoglossus vulgaris* Flem.

Of this species I have a series of individuals, of which the smallest I have been able to identify (namely, by counting the vertebrae), is of a length of 13·5^{mm}, the largest being 34^{mm}.

The youngest stage figured on Pl. I fig. 5 is apparently still quite symmetrical. The most conspicuous feature is the peculiar shape of the snout, which gives the little fish a *Zeugopterus*-like appearance. Above and in front of the eyes there is a deep depression, and then the snout bends upwards as a complete "pug-nose".

The notochord has just begun to bend upwards, but is still almost straight. Large larval pectorals are present, but ventrals are still quite wanting. In the dorsal and anal part of the marginal fin, which is broad and larval, there are only embryonic rays, but the interspinous bones begin to appear as a somewhat opaque part of the fin next the body-segments. The caudal part of the marginal fin shows rather conspicuous traces of developing rays. The pigmentation is not very characteristic. There is no arrangement into bars or groups, and the pigment is on the whole less conspicuous than in corresponding stages of other pleuronectids as *Drepanopsetta*, *Pleuronectes microcephalus* and *Pl. cynoglossus*. Even if we look at the specimen against a white back-ground, the pigment may hardly be observed with the naked eye. It consists of small black chromatophores arranged on the lines between the muscle-segments. Ventro-laterally, there are ca. 3—4 faint longitudinal rows, dorso-laterally only a single one. They extend from the vent to the base of the tail. No external pigment appears medio-laterally. Small black points appear on the vertical fin (though not on its caudal part) especially near the margin. There is very little pigment on the trunk and head. Yet a rather conspicuous ventral median-row appears, consisting of minute pre-anal chromatophores. The most characteristic features are: the peculiar shape of the head, especially the "pug-nose" and the very long straight-lined lower jaw, whose lower angle is very prominent. The eyes are very large in this as in all subsequent stages.

The next stage (Pl. I. Fig. 6) of which 2 specimens are at hand, measures 16$^1/_4{}^{mm}$; 16 + 34 vertebrae have been counted. The left eye is placed a trifle higher than the right one. The notochord is now ca. 30° turned upwards, and the caudal-fin shows distinct traces of developing rays, whilst these are still wanting in the other parts of the marginal fin and in the pectorals. Yet the developing interspinous bones appear like a low opaque roll. The ventrals are wanting. With regard to the pigment it should be noted that, as in a post-larval Gadoid the brain behind the eyes shows some round black distinct chromatophores, that are peculiar and characteristic to this and the ensuing stages. The pigment resembles on the whole that of the preceding stage, it is also here little conspicuous and does not gather into bars.

Whilst small points appear on the dorsal- and anal-fin, the caudal in this and the following stages does not show any pigmention at all. The gastric region has a few scattered distinct specks; a few also appear on the angle of the lower jaw. As this and the other pelagic halibut captured by me, were examined in a living state, I am able to furnish some details regarding its appearance when living. The eyes are of a light blue, and all pigment but the black is almost quite wanting. Under a lens some very fine reddish spots may be observed on the borders between the muscle-segments. They impart to the otherwise clear and transparent fish a faint reddish tint.

Of the following stage (length 18—20^{mm}) I possess 6 specimens, of which one 18^{mm} long is figured on Pl. I. Fig. 7. In one of these the number of vertebrae was found to be 16 + 34. For the rest they do not differ much from the preceding stage. Yet the dorsal- and anal-fin show an initial development of rays, though not very conspicuous, even in the largest specimen of a length of 20^{mm}. The pigmentation is the same as in the preceding stage. (Note the pigment on the brain, the undulating dorso- and ventro-lateral longitudinal lines of minute black chromatophores.

The next size is of a length of 22—23^{mm}, and 5 specimens are at hand (Pl. I. Fig. 8). The development of the dorsal and anal rays has now proceeded so far, that they may be counted (the figured specimen numbered 103—104 rays in the dorsal and 82—83 in the anal) the last rays are however very indistinct in both fins. The notochord is now less distinct. A glimpse of the left eye may just be caught above the outline of the head. The shape of the head is still most characteristic ("pug-nose" and long straight-lined lower jaw). The pectorals are large and larval without true rays. The ventral fins have just begun to develop and are very small. The pigment now begins to show a tendency to gather into groups on rays and interspinous bones. Thus a faint gathering into 3 groups may be noticed on the anal-fin.

By a little increase in size the arrangement into groups of the pigment is more conspicuous (see Pl. I. Fig. 9). This holds good with regard to all 3 specimens, the length of which is from 24$^1/_2$—25^{mm}. On the anal-fin (interspinous bones and rays) 3 conspicuous pigment-groups (besides one at anus) may be seen; they are equi-distant as in *Pleuronectes microcephalus* (see PETERSEN's last treatise 1904, l. c., Pl. II. Fig. 18—21), which is not the case in *Drepanopsetta* (PETERSEN 1904, l. c. Pl. I. Fig. 6—11). Smaller intermediate spots now appear on the rays. On the dorsal-fin 4 somewhat considerable pigment-groups may now be noticed on the interspinous bones and rays, and between these smaller secondary patches on the rays. A little black pigment also appear on the small ventral-fins, whereas pigment is quite wanting on the pectoral- and caudal-fins. The pigment on the sides is somewhat more conspicuous, but in the main unchanged. The pigmentation is a little slighter on the left side than on the right. In the dorsal-fin of the figured specimen 103 rays were counted, in the anal 80. The pectorals are still large and larval; when submitted to a closer microscopical investigation embryonic rays were seen, but besides these there was moreover a very faint trace of developing rays.

In a specimen of a length of 27^{mm} (see Pl. I Fig. 10) we notice the next stage of pigmentation. 5 groups appear now distinctly on the interspinous bones and rays of the dorsal-fin, besides the smaller intermediate ones on the rays. Medio-lateral pigment also begins to appear; it is especially conspicuous off the space between the two hindmost principal groups. The left eye is now rising ca. $^1/_4$ above the outline of the head. The specimen examined had 104 rays in the dorsal- and 82 in the anal-fin.

The next specimen at hand measures 29$^1/_2$^{mm}. It is figured on Pl. I Fig. 11. It has 105 dorsal- and 82 anal-rays. The left eye rises here one half above the outline of the head. The pectorals are still

large and fan-shaped and show an initial development of rays. The development of the pigment is more marked than in any of the smaller specimens. The round black well-limited chromatophores on the brain are still most characteristic. Another characteristic feature is the caudal-fin which here as in all preceding stages is quite without pigment. Faint traces of 4 transversal patches of pigment now appear on the body off the spaces between the principal groups on the interspinous bones and rays.

The largest specimen at hand has a length of 34^{mm} (Pl. I. Fig. 12). The migration of the left eye to the right side is not yet completed; as in full-grown specimens of the blue halibut it is situated on the dorsal ridge looking upwards. The outline of the eyes is now somewhat oblong, not circular as in the preceding stages. The considerable size of the eyes as well as the stoutness of the head are still very characteristic. A spinous armature on the head (gill-cover etc.) like that which distinguishes the witch and several sinistral pleuronectids could not be made out, either in this or in the preceding stages, although much attention was paid to the matter.

The pectorals are still large and fan-shaped, having not yet undergone the reduction which gives them their final appearance, but traces of developing rays are visible. The shape of the caudal-fin is very characteristic; it is extremely broad and the hind margin is not rounded as in the corresponding stages of other pleuronectids but nearly straight; the rays are very broad. Generally, the fish has increased in breadth and also in thickness so that it has become more opaque. The base of the tail, i. e. the part from the last rays of the dorsal and anal to the caudal-fin, is short, and in this fact the halibut approaches to the lemon dab, while in the long rough dab this part is much longer though not so extremely long as in the blue halibut (compare the figures by PETERSEN l. c., 1904. Pl. I and II).

The pigmentation has increased very much and the right side of the fish now shows much more pigment than the left. By the arrangement of the pigment the little fish has already got somewhat of the marble appearance so characteristic of young halibut. Otherwise the drawing (Pl. I. Fig. 12) renders a detailed description of the pigment unnecessary; it shows a further development of the pigmentation of the preceding stage (Fig. 11) besides the appearance of some new patches on the dorsal and anal fins. On the caudal two faint round patches have appeared; they are characterised by their position being in the proximal part of the fin, while in *Drepanopsetta* there are several black chromatophores irregularly scattered over the whole fin along the rays (see fig. 4). The dorsal rays could not be counted with great accuracy; in the anal 80 rays were found.

For want of material I am unable to pursue the development any further. The next known size is of 120^{mm}, but the metamorphosis is of course completed and the characters like those of the full-grown fish. Young halibut of a length of about 20 cm. are very common in shallow water round Iceland.

List of localities where pelagic post-larval halibut *(Hippoglossus vulgaris)* have been caught.

West of Færoe-Islands.

May 1904.

"Thor" Station 100. May 22th. 61°21′ N 10°59′ W.
Depth: more than 500 fathoms according to sea-chart. Temperature (surface): 8°50.
1) Young-fish trawl 15 meters wire out, 30 minutes.
1 *Hippoglossus vulgaris* (length 13$^{1}/_{2}$^{mm})

Off Southern Coast of Iceland.

May 1904.

"Thor" Station 113. May 24th. 63°31′ N. 16°06′ W.
Depth: 116 meters. Temperature (surface): 8°01, bottom 7°22.
1) Young-fish trawl 15 meters wire out, 20 minutes.
1 *Hippoglossus vulgaris* (length 24$^{1}/_{2}$^{mm}).

Off Western Coast of Iceland (Denmark Straits).
June—July 1904.

"Thor" Station 151 June 19th. 65°25′ N 27°30′ W.
Depth: c. 750 meters. Temperature: surface 7°65.
1) Young-fish trawl 15 meters wire out (near the surface), 15 minutes.
1 *Hippoglossus vulgaris* (length 29½mm).
2) Young-fish trawl 70 meters wire out, 15 minutes.
2 *Hippoglossus vulgaris* (length 22mm and 24½mm).

"Thor" Station 152. June 19th. 65°00′ N 28°10′ W.
Depth: 1240 meters. Temperature: surface 8°30, bottom 4°00, 100 meters 6°53.
1) Young-fish trawl 1000 meters wire out, 30 minutes.
1 *Hippoglossus vulgaris* (length 25mm).
2) Young-fish trawl 200 meters wire out, 30 minutes.
1 *Hippoglossus vulgaris* (length 22mm).

"Thor" Station 153. June 20th. 65°20′ N. 27°12·5′ W.
Depth: 740—768 meters. Temperature: surface 7°87, bottom (765 meters) 0°10, 100 meters 6°40.
1) Young-fish trawl 820 meters wire out, 30 minutes.
1 *Hippoglossus vulgaris* (length 27mm).

"Thor" Station 154. June 20—21th. 65°27′ N. 27°10′ W.
Depth: 700—765 meters. Temperature: surface 7°71; 100 meters 6°52; 600 meters 5°84.
1) Young-fish trawl 50 meters wire out, 4 hours.
1 *Hippoglossus vulgaris* (length 23mm).
2) Young-fish trawl 15 meters wire out, 1 hour.
1 *Hippoglossus vulgaris* (length 16½mm).
3) Young-fish trawl 80 meters wire out, 1 hour.
2 *Hippoglossus vulgaris* (length 19½mm and 22mm).
4) Young-fish trawl 75 meters wire out, 3 hours.
5 *Hippoglossus vulgaris* (length 16¼mm, 18mm, 19mm, 19¼mm and 19½mm).

"Thor" Station 155. June 21th. 65°28′ N. 26°20′ W.
Depth: 223 meters. Temperature: surface 7°69, bottom 5°78.
1) Young-fish trawl 15 meters wire out, 30 minutes.
1 *Hippoglossus vulgaris* (length 22mm).

"Thor" Station 173. July 7th. 64°07′ N. 22°39′ W.
Depth: 44 meters. Temperature: surface 10°70, bottom 8°61.
1) Young-fish trawl 50 meters wire out, 20 minutes.
1 *Hippoglossus vulgaris* (length 34mm).

II. *Hippoglossus hippoglossoides* (Walb.).

The youngest specimen of this species, which I have had the opportunity of examining, originates from the Davis Straits, where it was taken by the Danish Ingolf-Expedition[1]).

It is of a length of 34mm, but nevertheless it is nearly quite symmetrical (Pl. I, fig. 1), an exceptional case among the flat-fishes. It is also most characteristic by its exceedingly elongated narrow shape;

[1]) The specimen was taken by a vertical haul on 65° 17′ N., 54° 17′ W., at a depth of 40 fms. The temperature at the surface was 5°1 C., at the bottom (55 fms.) 0°9 C.

these two facts are quite sufficient to render confounding with any other flat-fish quite out of the question, It is perhaps more likely, that on first examining this specimen we may meet with some difficulty in imagining that it really is a young flat-fish. That this however, is the case, is proved by the compressed shape of the body, by the fact that the left eye is situated a trifle higher than the right, further by the resemblance to older stages, where the characteristic features are more like those of the full-grown fish, finally by the number of the vertebrae, which I have found to be about 62 or 63 (18 + 44 or 18 + 45) consequently the same figures, which were found by investigation of the full-grown fish. (See p. 4). In addition we may count the rays of the anal fin, which gives about 73, quite in accordance with *Hippoglossus hippoglossoides*.

The outline of the head and body almost forms a straight line. The notochord is stout, but strongly bent upwards. The pectorals are larval with only embryonic rays. Ventrals are wanting. In the caudal we notice 19 distinct true rays. The dorsal- and anal-fins are on the contrary still very slightly developed, they consist for the greater part of the original embryonal-fin, which has embryonic rays. There is, however, trace of the interspinuous bones, and the bases of a considerable number of the permanent rays also appear. In the anal-fin 73 rays may be counted by aid of rays and interspinous bones. We meet however with more difficulty in counting those of the dorsal-fin, as the development still is very slight here, especially in front. The pigment is practically wanting; this may, however, partly be due to the fact, that the specimen has been preserved in spirit as are also the other specimens of this species.

The next stage[1]) placed before me is of a length of $36^1/_2$ mm (Pl. I, fig. 2). In spite of the fact, that its length only measures a few millimetres more than the above-mentioned, it is considerably more advanced in development. Thus the left eye may be noticed just above the outline of the head, the caudal- as well as the dorsal- and anal-fins have obtained the final number of rays, and the thickness of the body has increased considerably. The pectorals are small, but still larval, and the ventrals are wanting. The notochord is less conspicuous. The shape of the fish is however very elongated, though broader than in the preceding stage. The length of the base of the tail (that is, the distance from the last ray in the dorsal- and anal-fin to the beginning of the caudal-fin) is here, as in all other known stages of this species very striking, as well as the pointed snout.

In addition to the two mentioned specimens, taken by the Ingolf-Expedition, the Zoological Museum of Copenhagen possesses a number of larger specimens originating from earlier collections made from the Danish colonies in West-Greenland, but without any indication of occurrence and means of capture. There are specimens of the following length: ca. 51 mm (see Pl. I, fig. 3), ca. 61 mm, ca. 65 mm, ca. 73 mm, ca. 96 mm, and ca. 125 mm, together with some of larger size. In these specimens the development may be pursued, both the migration of the left eye and the transformation of the pectorals from the larval to the final stage. In the three smallest specimens (51, 61 and 65 mm) the eye has not yet reached its final vertical position in the middle of the dorsal ridge, this is however the case in that of a length of 73 mm. The pectorals have obtained their final appearance in specimens of 96 mm and 125 mm, whilst they, in that of 73 mm, besides the rudiments of true rays have only embryonic rays. The development and metamorphosis is, compared with that of other pleuronectids, exceedingly slow. Thus we noticed in a specimen of 34 mm that the rays were not quite formed[2]). Among the flat-fishes it is also quite an exceptional fact, that the migration of the eye should not be completed till at a length of 70 mm. The appearance of the young stages of this species — probably the most arctic flat-fish — is consequently so

[1]) The specimen was taken in the trawl by the Danish Ingolf-Expedition at Station No. 36, July 28th, 1895 at 61° 50′ N., 56° 21′ W. (Davis Straits), Depth 1435 fms, temperature at the bottom 2°0 C. To judge from its appearance it has surely been pelagic.

[2]) A corresponding example may be taken from the Gadoids. Thus the pelagic young of the arctic *Gadus saida* reach a more considerable size than any other species of the same genus, before the rays of the dorsal- and anal-fin are formed.

peculiar and easily recognizable, that they cannot possibly be confounded with those of any other species, for which reason I think a further description and illustration of the older stages superfluous.

III. On the distinction between post-larval halibut and other pleuronectids.

On this subject it may be useful to say a few words, now the development of the two species is known. In the first place we have *Hippoglossus hippoglossoïdes*. The pelagic stages of this species cannot possibly be confounded with those of any other species on account of their exceedingly narrow elongated shape and the considerable length they reach, before true rays are formed in the dorsal- and anal-fin. In the latest pelagic stages *H. hippoglossoïdes* may at once be distinguished from all other species by its enormous size and the peculiar position of the left eye.

The pelagic young *H. vulgaris* are also very well characterized, though not differing from all other pleuronectids to such a degree as those of the blue halibut. There may after all only be a question about confounding them with the young *Drepanopsetta*, which species they may resemble in certain stages of their life. In order to avoid such a mistake, I shall here call attention to the more important distinguishing features (compare further my figures 4 and 8, representing a post-larval halibut and a *Drepanopsetta* of the same size). With regard to nearly all known stages of the pelagic *H. vulgaris* the following holds good:

1) The head is much stouter and its shape is very different from that of *Drepanopsetta*, the strong depression above and in front of the eyes, the "pug-nose" and the very long straight-lined lower jaw being specially characteristic.
2) The eyes are much larger than those of a *Drepanopsetta* of the same size and development.
3) The caudal-fin is without pigment, whilst all the hundreds of pelagic *Drepanopsetta* of different stages, which I have examined, showed black pigment-specks, irregularly scattered, on the caudal-fin along the rays over the whole fin, in all cases where the pigment had been preserved. (See Pl. I, fig. 4.)[1] Only the largest present post-larval halibut (of about 34^{mm}'s length) showed pigmentation on the caudal fin, the pigment consisting of two faint round patches regularly placed on the proximal part of the fin. In all the other stages under observation and ranging from $13^1/_2$ to $29^1{}_2{}^{mm}$ no trace of pigmentation on the caudal fin was found.
4) In the pelagic *H. vulgaris* we find on the brain a small number of characteristic, round, well-limited, very black pigment-spots (as in Gadoïds). This brain-pigment is wanting in the pelagic *Drepanopsetta*[2].

Whilst the diagnostic characters here stated hold good for all known stages of pelagic halibut, there are also other distinguishing features, which, however, are not applicable to all stages.

A. Younger stages below a length of about 20^{mm}. Small halibut measuring less than about 20^{mm} may very easily be distinguished from the small *Drepanopsetta* by the shape of the head, the "pug-nose" being especially conspicuous in the early stages. Another distinguishing feature between them and the small *Drepanopsetta* is, that the pigment is far less conspicuous, and that pigment-groups are wanting. These groups are very characteristic in *Drepanopsetta*, where at any rate the 3 ventral ones on the interspinous bones are in most cases visible to the naked eye, when we look at the specimen against a white back-ground[1]. (See Petersen, 1904, l. c. Pl. I, fig. 5—8.) The sides of the body on the contrary

[1]) The Icelandic specimens of *Drepanopsetta* generally show more pigment than specimens from Danish waters.

[2]) In highly pigmented *Drepanopsetta* near the metamorphosis-stage, a little pigment may sometimes be noticed on or near the brain, but it consists of greyish indistinctly limited spots and is very different from the characteristic, very black brain-pigment of the halibut.

show undulating longitudinal lines of fine, black points. There is again the difference, that the rays in the dorsal- and anal-fin develop later than those of *Drepanopsetta*. In this respect PETERSEN's *Drepanopsetta* of a length of $12^1/_2{}^{mm}$ (1904, l. c., fig. 7) almost corresponds to my halibut of 18^{mm} (Pl. I, fig. 7).

B. Older stages above a length of about 20^{mm}. The highly characteristic ventro-lateral, straight-lined row of large pigments spots, which often appear in *Drepanopsetta* (see Pl. I, Fig. 4), is wanting in the halibut. The pre-anal pigment-row is also less conspicuous than in *Drepanopsetta*. The head is larger and stouter and less distinctly marked from the body than in *Drepanopsetta*. The snout has not the evenly rounded, obtuse-angled shape, which distinguishes *Drepanopsetta*, and to a still higher degree, *Pleuronectes microcephalus*. (See PETERSEN's Fig., 1904, l. c. Pl. I and II.) The body of the halibut is thicker, broader and more evenly arched than that of *Drepanopsetta*, it is also without the very prominent gastric region, which frequently distinguishes the latter. The base of the tail (the distance from the last ray in the dorsal- and anal- to the caudal-fin) is moreover shorter than in *Drepanopsetta*, the caudal-fin is much broader behind, its hind edge being also more straightly cut off.

By applying the mentioned characters on well-preserved young stages of *Drepanopsetta* and halibut, the two species can easily be distinguished without employing anatomical features as number of vertebrae. In case, that it nevertheless might be thought desirable to control the exactness of the determination by counting of vertebrae, I shall here add the following numbers of vertebrae for *Drepanopsetta*.

62 *Drepanopsetta* from Iceland.

Vertebrae without and with lower arches	Number of specimens investigated
12 + 33	5
12 + 34	2
13 + 32	8
13 + 33	37
13 + 34	7
13 + 35	1
14 + 33	2

37 *Drepanopsetta* from Denmark [1]).

Vertebrae without and with lower arches	Number of specimens investigated
12 + 32	9
12 + 33	9
13 + 31	2
13 + 32	8
13 + 33	9

Drepanopsetta.

49 specimens caught round Iceland [2]).

Number of rays in Dorsal	Number of specimens investigated	Number of rays in Anal	Number of specimens investigated
100	1	76	1
98		74	2
96	1	72	11
94	2	70	5
92	3	68	3
90	6	66	4
88	5	64	5
86	4		2
84	3		1
82	2		

[1]) According to A. C. JOHANSEN's and A. OTTERSTRØM's counting of vertebrae, published in PETERSEN's work, 1904, p. 11.

[2]) I profit by the occasion to advise in future a statement of fin-rays in this way, not only stating the highest and lowest figure, which really does not offer much information, as to which number most frequently occurs.

These two numeral series found in specimens from very distant and different waters, show the number of vertebrae always to be less high in *Drepanopsetta* than in the halibut. We possess in this fact a reliable and numerical distinguishing mark between the two species, which may be used if needed. The number of rays in the dorsal- and anal-fin will however in many cases enable us to make a just separation, which will be seen by comparing the above table with the former on p. 4.

Consequently, when we feel doubtful about identifying a little fish as belonging to *Hippoglossus vulgaris* or to *Drepanopsetta*, it will almost always be a halibut, if the dorsal-fin has more than 100 rays. The highest number of rays, which on the whole has been counted in *Drepanopsetta* is 101 in the dorsal and 79 in the anal-fin, namely by COLLETT in arctic specimens. (Norw. North-Atl. Exp. Zool. Fishes 1880.) It is a well-known fact, that arctic specimens generally have more rays than those living in more southern waters.

Finally according to the experiences from Iceland and the Færoe-Isles, it should be noted that the pelagic *Drepanopsetta* in most cases live in far more shallow water than the pelagic *Hippoglossus vulgaris*. Further details regarding the occurrence of the *Hippoglossus* may be derived from the above list, comprising the localities, where they have been taken by the "Thor".

November 1904.

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EXPLANATION OF THE PLATE

Hippoglossus hippoglossoïdes.

Fig. 1. Davis Straits. The Danish Ingolf Expedition, Station No. 34 (see page 8, footnote). July 18th 1895, tow-net, vertical haul. **Length 34**mm.

Fig. 2. Davis Straits. The Danish Ingolf Expedition, Station No. 36 (see page 9, footnote). July 28th 1895, trawl. **Length 36** 1/2 mm.

Fig. 3. Davis Straits. West-Coast of Greenland. **Length 51**mm.

Drepanopsetta platessoïdes.

Fig. 4. "Thor" Station No. 163. West-Coast of Iceland (Denmark Straits) (65° 10′5 N., 24° 05′ W.). Depth: 79 meters. June 27th 1904. Young-fish trawl, 85 meters wire out. **Length 22**mm. — To be compared with fig. 8, a *Hippoglossus vulgaris* of the same size.

Hippoglossus vulgaris.

Fig. 5. West of Færoe Islands. "Thor" Station 100, May 22th 1904 (see page 7). **Length 13** 1/2mm.

Fig. 6. Denmark Straits. "Thor" Stat. 154. June 20th 1904 (see p. 8). **Length 16** 1/4mm.

Fig. 7. Denmark Straits. "Thor" Stat. 154. June 20th 1904 (see p. 8). **Length 18**mm.

Fig. 8. Denmark Straits. "Thor" Stat. 152. June 19th 1904 (see p. 8) **Length 22**mm. — (To be compared with fig. 4.)

Fig. 9. Denmark Straits. "Thor" Stat. 151. June 19th 1904 (see p. 8). **Length 24** 1/2mm.

Fig. 10. Denmark Straits. "Thor" Stat. 153. June 20th 1904 (see p. 8). **Length 27**mm.

Fig. 11. Denmark Straits. "Thor" Stat. 151. June 19th 1904 (see p. 8). **Length 29** 1/2mm.

Fig. 12. Denmark Straits. "Thor" Stat. 173. July 9th 1904 (see p. 8). **Length 34**mm.

N. B. Fig. 4—11 have been drawn under a higher magnification than Fig. 1—3. No attempt has been made to give the real number of fin-rays, which when possible is stated in the text. By the reproduction of the original drawings the free tip of the notochord of Fig. 8 has been made somewhat too long.

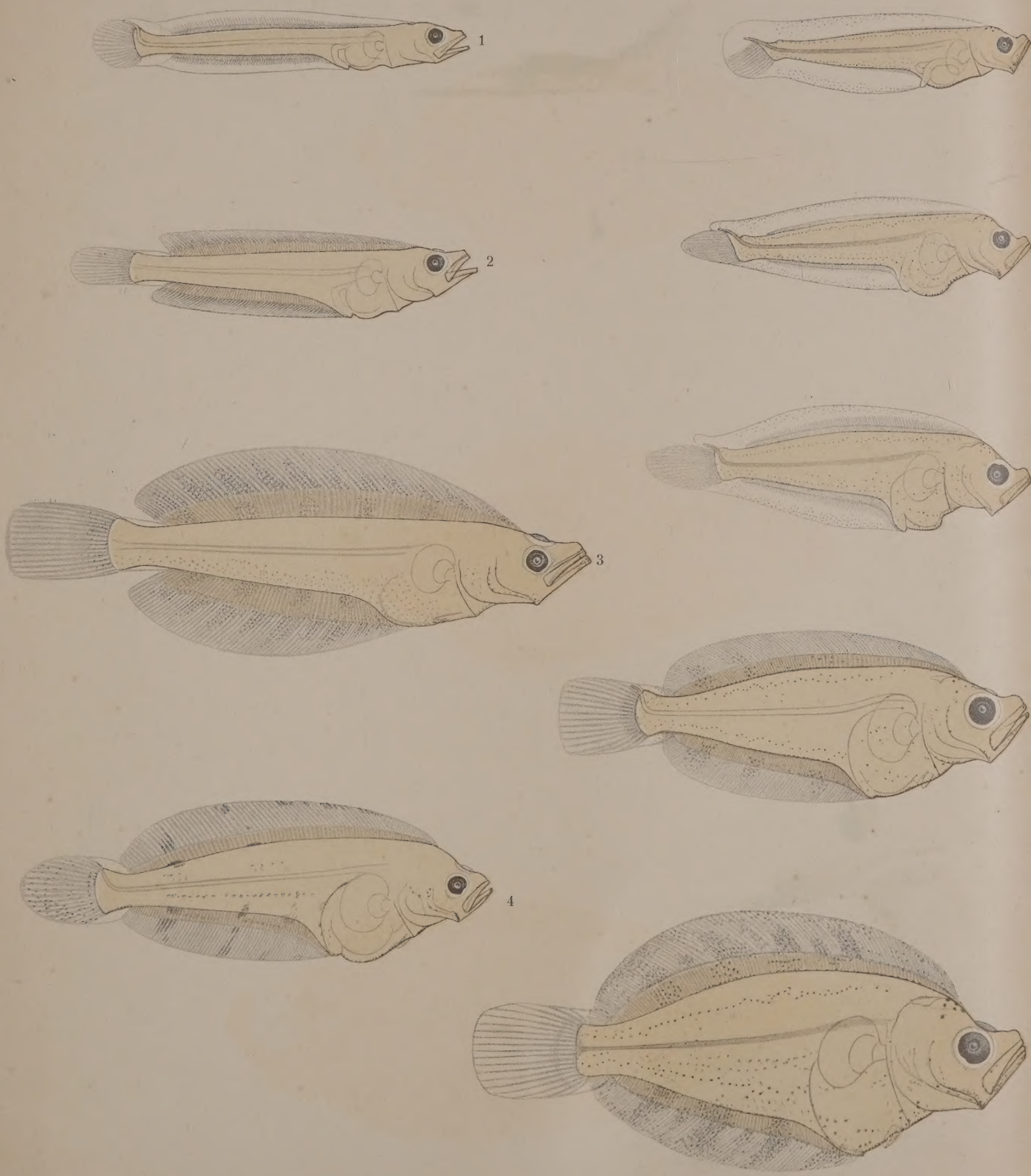
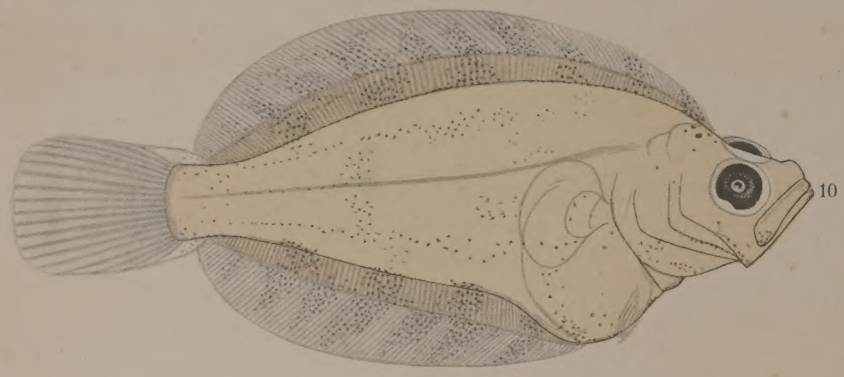


Fig. 1—3 *Hippoglossus hippoglossoïdes* (Walb.) (about 2½ × nat. size); Fig. 4 *Drepanopsetta platessoïdes*

Westergaard del.



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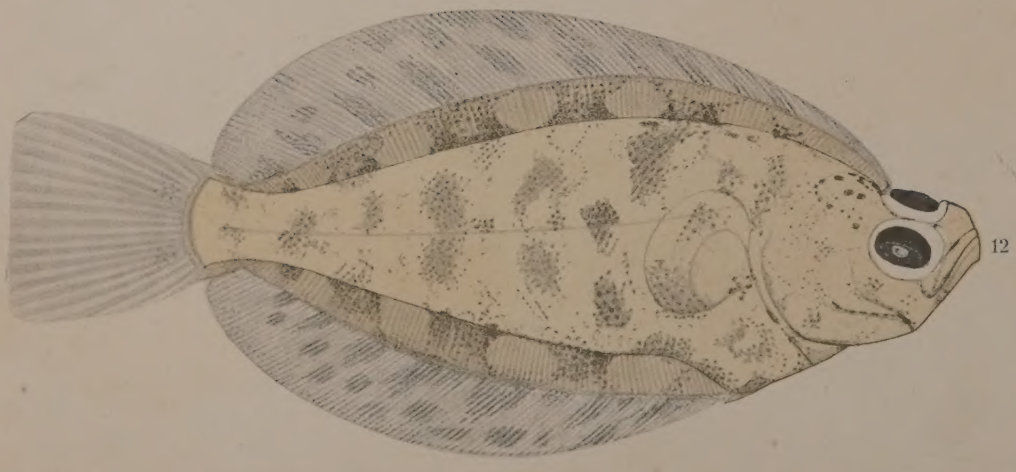

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O. Fabr.); Fig. 5—12 *Hippoglossus vulgaris* Flem., (Fig. 4—12 about 4½—5 × nat. size.)

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